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Testing a Communal Goal Affordance Intervention for Increasing Women's S.T.E.M. Motivation

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TESTING A COMMUNAL GOAL AFFORDANCE INTERVENTION FOR INCREASING WOMEN'S S.T.E.M. MOTIVATION

By

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Abstract

The current research aims to integrate previous research on the host of negative consequences associated with women's experience of stereotype threat in a science context. Using an expectancy-value framework, the current research explores potential indirect effects of a communal goal affordance intervention on science motivation, via stereotype threat, state anxiety, communal goal affordances, and belonging in science. Building upon the previous literature, the current research attempts to link stereotype threat to science motivation via communal goal affordances and state anxiety's effect on belonging in science. Additionally, the current research attempts to illustrate the efficacy of a communal goal affordance intervention by increasing perceptions of communal goal affordances and reducing anxiety in a science context. The current study found no evidence of a successful implementation of the communal goal affordance intervention, as evident by non-significant results on parametric and non-parametric tests of central tendencies between interaction type. Additionally, no indirect effects on science motivation were discovered within either tested pathway. However, a significant positive relationship between stereotype threat and state anxiety, communal goal affordances and belonging in science, and belonging in science and science motivation were found. Limitations to the current study and the communal goal affordance intervention, as well as the implications for these findings and future directions for research are discussed.

Keywords: stereotype threat, women, STEM, science motivation, belonging, communal goal affordances, science identification, state anxiety

TESTING A COMMUNAL GOAL AFFORDANCE INTERVENTION FOR INCREASING WOMEN'S S.T.E.M. MOTIVATION

The United States lags behind most of the modern world in Science and Mathematics professionals, falling short about 3 million science, technology, engineering, and mathematics (STEM) employees in 2015 (National Science Foundation [NSF], 2016). One commonly promoted strategy for increasing the number of STEM professionals is to diversify the workforce by increasing employment within underrepresented groups. Women are significantly underrepresented in STEM fields, receiving less than twenty percent of all computer science, engineering, and physics bachelor's degrees while assuming only twenty-five percent of all computer science, mathematics, and engineering jobs in the U.S. (NSF, 2015). In the recent past, despite having similar educational opportunities and experiences as their male counterparts, women still elect out of STEM at higher rates than men (Smith, Lewis, Hawthorne & Hodges, 2013). These findings suggest an explanation beyond opportunity for women's lack of motivation to pursue STEM.

The current research seeks to explore for an alternative explanation of what motivates women to pursue STEM careers by examining the role of stereotype threat, communal goal affordances, state anxiety, and belonging in science as determinants of motivation within an expectancy-value framework. Additionally, this project aims to implement a communal goal affordance intervention for increasing women's science motivation. This introduction will begin by reviewing the current state of the research on stereotype threat's effects on belonging in science and science motivation in women. It will then outline the expectancy-value framework and how it informs the current research, followed by a discussion of the current research on state anxiety and communal goal affordances in relation to women's sense of belonging in science.

Next, this introduction will illustrate how all of these factors contribute to women's science motivation, and explain their fit within this study's indirect effects model of women's science motivation. Lastly, this introduction will provide an overview of how this study aims to manipulate these previously implicated factor, thus increasing women's science motivation.

Stereotype Threat and Male Dominance in Science. The perception (and the reality) of male dominance in STEM fields has been shown to have significant negative effects on women's self-perceptions of their own performance and their sense of belonging within STEM domains, which, in turn, negatively impacts women's motivation to pursue STEM careers (Steele, Spencer, and Aronson, 2002; Murphy, Steele, & Gross, 2007). For example, when mathematics, science, and engineering fields are visually portrayed as being male dominated (e.g. a research presentation full of men), women self-reported a lower sense of belonging in STEM fields as compared to a control group (Murphy, Steele, & Gross, 2007). This effect has been attributed to a construct called stereotype threat, typically conceptualized as a form of identity threat, which is characterized by the fear or anxiety that one's performance may be viewed through the lens of a negative stereotype (Steele & Aronson, 1995; Steele, Spencer, & Aronson, 2002).

In the case of women and STEM, this may manifest itself in a belief by women that they are less capable of performing well in science and mathematics domains as compared to men; eventually leading to negative effects on performance and an aversion of STEM domains. The experience of stereotype threat has been found to lead to significant decreases in mathematics performance in women as compared to those who perceive a gender balance in STEM (Shaffer, Marx, & Prislin, 2013). Furthermore, the elicitation of stereotype threat via commercials that conveyed women in stereotypic roles resulted in underperformance on a mathematics test, women preferring non-quantitative questions, as well as less expressed interest in quantitative

fields as compared to those in a control condition (Davies, Spencer, Quinn, & Gerhardstein, 2002).

Numerous potential mediating factors for the link between stereotype threat and science motivation in women have been explored in the literature. Previous research has found evidence for the role of sense of belonging (Master, Cheryan, & Metlzoff, 2016; Thoman, Smith, Brown, Chase, Lee, 2013), perceptions of communal goal affordances (Smith, Brown, Thoman, & Deemer, 2015), and anxiety (Smith, Brown, Thoman, & Deemer, 2015) as factors affected by stereotype threat that contribute to women's science motivation. The current research aims to build upon the previous literature by focusing on these constructs within an expectancy-value theoretical framework (building on the work of Smith, Brown, Thoman, & Deemer, 2015), in order to test their relationship to women's science motivation.

The Expectancy-Value Framework and Communal-Value Intervention. The current research is informed by an expectancy-value framework, in which one's motivation is a dynamic combination of their expectancies of success and their sense of value in a given domain (Eccles, Adler, Futterman, Goff, Kaczala, Meece, & Midgley, 1983; Eccles & Wigfield, 1995; Eccles, 2005). Within the scope of the current research, the expectancy component is characterized as state anxiety (i.e. anxiety in a STEM context) while the value component is characterized as perceptions of the utility value of science. Broadly defined, utility value refers to the belief that a domain or activity has the potential to fulfill some long-term or short-term goal of an individual. In this context, women's motivation to pursue science is a function of their expected success and anxiety in a STEM context, and their perceptions of utility value in a STEM domain.

Within the current research, there is a focus on communal value as the form of utility value of interest. Communal value involves opportunities for communion, such as working with

and/or helping other people. Women have been found to place an emphasis on communal value (Brown, Smith, Thoman, Allen, & Muragishi, 2015), as compared to men. The perception that a given domain does or does not, in fact, offer opportunities for communion is known as communal goal affordances. These communal goal affordances serve as the value component within the current framework. A perceived lack in communal goal affordances may deter women from pursuing STEM fields, especially in those women that place more emphasis on communal value (Diekman, Brown, Johnson, & Clark, 2010). Furthermore, women who emphasize communal value are averse to environments that are not rich in communal goal affordances, even to go as far as avoiding opportunities for professional advancement by refusing promotions or transfers (McCarty, Monteith, & Kaiser, 2014).

State anxiety, or anxiety experienced in a particular context (e.g. STEM), serves as the expectancy component within the current framework. When a member of a stereotyped group experiences anxiety in a given context (e.g. STEM), they are more likely to behave in stereotypical ways (Steele & Aronson, 1995). Additionally, anxiety is a contributing factor to academic engagement (Wilcox, McQuay, Blackstaffe, Perry, & Hawe, 2016). This self-fulfilling prophecy has a cyclical effect; not only does it discourage women from pursuing STEM, it also reinforces the negative stereotypes about women in STEM thus promoting increased salience of stereotype threat. The link between stereotype threat and anxiety has been illustrated in the literature (Smith, Brown, Thoman, Deemer, 2015), however anxiety's specific effect on belonging and motivation within a STEM context has yielded inconsistent results. The current research subsequently aims to contribute to the understanding of anxiety's role in women's science motivation.

Belonging's Impact on Motivation. Stereotype threat (Master, Cheryan, & Metlzoff, 2016; Smith, Brown, Thoman, & Deemer, 2015) and perceived communal value (Smith, Brown, Thoman, & Deemer, 2015) have been demonstrated as having an impact on women's sense of belonging. Although the link between stereotype threat and anxiety has been documented (Smith, Brown, Thoman, & Deemer, 2015), research has yet to identify a direct relationship between anxiety and belonging in this context. Lacking a sense of belonging in STEM has significant effects on women's science motivation. Women who reported a lower sense of belonging in a computer sciences classroom also experienced lower self-reported motivation to pursue STEM careers (Master, Cheryan, & Meltzoff, 2016). It has been further asserted that women's sense of belonging in STEM is the causal link between stereotypical thoughts about women's role in STEM (lending itself to stereotype threat) and their motivation towards pursuing a STEM field (Master, Cheryan, & Meltzoff, 2016).

As the relationship between belonging in science and science motivation has been illustrated robustly in the literature, the current research should also find this relationship. A goal of the current research, however, is to explore how a communal goal affordance intervention may indirectly affect science motivation, by affecting belonging via stereotype threat, communal goal affordances and anxiety in a STEM context.

The Communal Goal Affordance Intervention. Research into the effectiveness of communal value interventions has shown that a communal value intervention aimed at asserting the notion that STEM fields offer communal value have been successful in increasing student's motivation to pursue STEM careers (Brown, et al., 2015). As a means of manipulating communal goal affordances and state anxiety, the current research aimed at generating an intimate interpersonal relationship in a STEM context. The generation of an intimate relationship in a

STEM context should lead to increases in participant's perceptions of communal value in STEM, leading to a higher sense of belonging in science and thusly increased motivation to pursue STEM fields.

To summarize, the expectancy-value framework serves as the theoretical framework for the current research. Within this framework, women's science motivation is the combined effect of participant's reported anxiety in a STEM context and their perceptions of utility value in science, specifically communal value, on their sense of belonging in science. The relationship between belonging is science should result in a robust effect on women's science motivation.

A Model for Women's STEM Motivation

We propose an indirect effects model for women's STEM motivation. We will manipulate communal goal affordances by way of an interpersonal interaction, in which we will generate an intimate relationship between same-sex peers. We predict that this manipulation will decrease participants' experience of stereotype threat and state anxiety as compared to a control manipulation. We hypothesize that women's perceptions of communal goal affordances in science will constitute an indirect effect on the relationship between stereotype threat and sense of belonging in science. We further hypothesize that as sense of belonging in science increases, so should participant's science motivation. Additionally, state anxiety may contribute to an indirect effect between stereotype threat and sense of belonging in science. The current model (Figure 1) hypothesizes that the effect of stereotype threat on women's sense of belonging in science and thusly their science motivation, is indirectly effected by their perception of communal goal affordances in science and their experiences of state anxiety in a STEM context.

Method

Participants and procedure. One-hundred and fifty-two female undergraduate students (69% Caucasian, 9% Latinos, 8% African-American, 8% Asian, 5%Mixed Race; 61% Psychology Majors; ages 18-57, median age = 20) from the psychology research participation pool at a mid-sized east coast university participated in exchange for partial course credit. All collected variables and planned analyses were pre-registered under the open science framework and is available for review (see appendix).

We made the gendered nature of science salient by having female participants and confederates and male experimenters, and having the participant and confederate complete a short demographic questionnaire at the beginning of the study in which they physically circled their gender. The male-dominated nature of science was emphasized by having the confederate and the participant review a flier (Figure 1) containing gender-imbalanced imagery (i.e. more males than females), which also emphasized the importance of scientific research, data transcription and data analysis.

After reading the flier, the participant and confederate completed two attention check questions about the content on the flier, and then the participant and the confederate were asked to face each other and take turns asking and answering six questions that were either very descriptive or superficial for 15 minutes. The research confederate was instructed to match the enthusiasm as well as the depth of description of the participant during the question and answer session.

Next, both the participant and the confederate completed a science themed copying task (Figure 2) for 8 minutes that involved copying a series of letters, or "data" from the computer screen on to gridded paper. Lastly, the experimenter placed a divider between the confederate

and the participant and then the confederate and the participant completed measures of stereotype threat, state anxiety, agentic and communal goal affordances, belonging in science, science motivation, partner ratings, science domain identification, and additional demographic information.

Independent Variables

The participant and the confederate were randomly assigned to either ask each other very descriptive questions ("Fast-Friends") or superficial questions (the "Small-Talk"; adapted from Aron, Melinat, & Aron, 1997; see Table 1). In the "Fast-Friends" condition participants and the confederate asked each other questions such as "Your house, containing everything you own, catches fire. After saving your loved ones and pets, you have time to safely make a final dash to save any one item. What would it be?" whereas in the "Small-Talk" condition participants and the confederate asked each other questions such as "What is your preferred method for getting the news and why?".

Dependent Variables

Stereotype threat. Participants' feelings of stereotype threat were measured using three items ("I am worried that my ability to perform well on this science task was affected by my gender."; "I am worried that if I performed poorly on this science task, others will attribute my poor performance to my gender."; "I am worried that, because I know the negative stereotype about women and science ability, my anxiety about confirming this stereotype negatively influenced how I performed on this science task.") (taken from Deemer, Thoman, Chase, & Smith, 2014) using scales ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Responses were averaged to create a stereotype threat composite measure ($\alpha = 0.62$).

Communal goal fulfillment. Participants' beliefs about science research fulfilling communal goals (such as working with and helping others) were assessed using 8 items (i.e., "How much do you believe that this research task fulfills goals such as working with people, helping others, and serving the community?"; "How much do you believe a career that uses science research fulfills goals such as working with people, helping others, and serving the community?"; taken from Brown, et al. (2015); modified from Diekman, Brown, Johnston, & Clark, 2010). Participants rated themselves on these items using seven point scales ranging from 1 (*Not at all*) to 7 (*Extremely*). Responses were separately averaged to create a communal goal affordance composite measure ($\alpha = 0.78$).

State anxiety. Participant's anxiety within the context of the interpersonal interaction was measured using 17 items (taken from Galanxhi & Nah, 2007). For instance, "I felt tense and nervous while talking."; "I felt self-confident while talking."; "While talking, I was afraid of making an embarrassing impression.". Responses were made on 4-point scales ranging from 1 (*Not at all*) to 4 (*Very much so*) and averaged to create a state anxiety composite measure ($\alpha = 0.85$).

Sense of belonging in science. Participants' sense of belonging explicitly within the context of science was measured by rating 10 items (i.e., "When I am in a scientific research setting such as this one I feel that I am a part of the science community."; "When I am in a scientific research setting such as this one I feel that I am insignificant.") on 7-point scales ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*) (taken from Good, Rattan, & Dweck, 2012). Responses were averaged to create a belonging in science composite measure ($\alpha = 0.83$).

Science motivation. Participant's motivation to complete/participate in science related tasks (adapted from Smith, Sansone, & White, 2007) was assessed by having participants rate 4

items ("How willing would you be to complete a research task similar to the one you completed in the future?"; "How willing would you be to volunteer in a research laboratory someday?"; "How willing would you be to look into joining a research laboratory?"; "How willing would you be to recommend this type of research to a friend?") on 7-point scales ranging from 1 (*Not at all*) to 7 (*Very willing*). Responses were averaged to create a science motivation composite measure ($\alpha = 0.83$).

Additionally, an indirect measure of persistence and future motivation was implemented via the science copy task. Participants number of copies completed within a time limit indicated persistence on a science themed copy task, while participant's responses to the question "How many times would you be willing to complete this task, give no time limit, in the future?" indicates future motivation (adapted from Daly, Wright, Kelly, & Martens, 1997).

Additional Exploratory Variables. Beyond our main dependent variables implicated in the preregistered analysis, the current study also collected additional exploratory variables to be used for further analysis. These include participant perceptions of their partner (validated and taken from Wiener, Gervais, Allen, & Marquez, 2013; Gervais, Vescio, & Allen, 2011) as well as science domain identification, or an assessment of how participants identify themselves within the domain of science (taken from Smith & White, 2001).

Results

Tests to check for a normal distribution were conducted on all dependent variables. The following dependent variables were non-normally distributed as indicated by skewness and/or kurtosis outside of accepted ranges for small samples (i.e. -0.50, 0.50): stereotype threat (Skewness = 0.94, Kurtosis = -0.30, *SE* = 0.09), state anxiety (Skewness = 0.52, Kurtosis = -0.88, *SE* = 0.06), communal goal affordances (Skewness = -0.59, Kurtosis = 0.16, *SE* = 0.13),

belonging in science (Skewness = -0.03, Kurtosis = -0.72, *SE* = 0.15), science motivation (Skewness = -1.29, Kurtosis = 2.98, *SE* = 0.08), science domain identification (Skewness = -0.65, Kurtosis = -0.36, *SE* = 0.10), partner ratings (Skewness = -0.51, Kurtosis = -0.08, *SE* = 0.10). Additionally, parametric tests for the assumption of homogeneity of variance were employed for those variables that did not violate the assumption of a normal distribution, whereas those dependent variables that did violate this assumption were subjected to a non-parametric alternative: stereotype threat (Median $X^2(1) = 0.244$, $p = 0.62$), communal goal affordances ($K^2(1) = 0.817$, $p = 0.37$), state anxiety (Median $X^2(1) = 1.735$, $p = 0.19$), Belonging in science ($K^2(1) = 1.363$, $p = 0.27$), science motivation (Median $X^2(1) = 2.717$, $p = 0.10$). Because violations of the assumptions of normality and/or homogeneity of variance were found for certain dependent variables, these variables were submitted to the non-parametric Kruskal-Wallis alternative to the one-way analysis of variance. A traditional one-way analysis of variance test was used for dependent variables that did not violate these assumptions.

Following this, we conducted path analysis on the current studies theoretical path model (Figure 3) to test whether an indirect effect emerged on science motivation through question type, stereotype threat, communal goal affordances, and belonging in science (i.e. Pathway 1), and whether an indirect effect emerged on science motivation through question type, stereotype threat, state anxiety, and belonging in science (i.e. Pathway 2).

Testing the Communal Goal Affordances Intervention

Because both parametric and non-parametric tests were used, reported statistics include either means or medians as measures of central tendency dependent on the test employed.

Participants in the small-talk condition (*Med.* = 1.33, *SD* = 0.82) did not differ from participants in the fast-friends condition (*Med.* = 1.17, *SD* = 0.99) on stereotype threat ($H(1) = 0.005$, $p = 0.94$).

Participants in the small-talk condition ($M = 4.88$, $SD = 1.10$) did not differ from participants in the fast-friends condition ($M = 4.67$, $SD = 1.19$) on communal goal affordances ($F(1) = 1.223$, $p = 0.27$).

Participants in the small-talk condition (*Med.* = 2.04, *SD* = 0.49) did not differ from participants in the fast-friends condition (*Med.* = 2.00, *SD* = 0.48) on state anxiety ($H(1) = 0.70$, $p = 0.40$).

Participants in the small-talk condition ($M = 4.88$, $SD = 1.28$) did not differ from participants in the fast-friends condition ($M = 4.96$, $SD = 1.11$) for belonging in science ($F(1) = 0.165$, $p = 0.69$).

Participants in the small-talk condition (*Med.* = 5.40, *SD* = 0.74) did not differ from participants in the fast-friends condition (*Med.* = 5.42, *SD* = 0.83) for science motivation ($H(1) = 0.20$, $p = 0.66$).

Testing for Indirect Effects

Indirect effects between question type and science motivation through stereotype threat, communal goal affordances and state anxiety were conducted using path analysis with bootstrapping (n = 1000; Figure 4). Pathway 1 looked at an indirect effect on science motivation through question type, stereotype threat, communal goal affordances, and belonging in science, and pathway 2 looked at an indirect effect on science motivation through question type, stereotype threat, state anxiety, and belonging in science.

Question type did not predict stereotype threat (β = 0.083, p = 0.57) and stereotype threat did not predict communal goal affordances (β = -0.11, p = 0.28). However, when participants perceived that science was communal, they were more likely to feel as though they belonged in science (β = 0.25, $p < 0.01$), and when participants felt as though they belonged in science they expressed more science motivation (β = 0.31, $p < 0.001$). Thus, no significant indirect effect emerged between question type and science motivation through stereotype threat, communal goal affordances, and belonging in science (β = -0.001, CI = -0.007, 0.002, p = 0.76)

Furthermore, the more participants experienced stereotype threat, the higher state anxiety they reported (β = 0.09, p = 0.050). However, state anxiety was not related to feelings of belonging in science (β = -0.16, p = 0.42). Thus, no significant indirect effect emerged between question type and science motivation through stereotype threat, state anxiety, and belonging in science (β = 0.001, CI = -0.003, 0.002, p = 0.77).

Discussion

The current study examined whether [1] we could successfully manipulate participant's science motivation by altering their perceptions of communal goal affordances in science as well as their state anxiety in a science context via our interpersonal interaction manipulation, and [2] whether there was evidence for indirect effects emerging between question type and science motivation within the current model?

The current study did not find any significant evidence that the communal goal affordance intervention was successful. Theoretically, fostering an intimate relationship (fast-friends condition) between two peers with a shared identity (i.e. women) should have had a buffering effect against the effects of stereotype threat on belonging in science by increasing one's perceptions of communal goal affordances in science and decreasing state anxiety in a

science context, subsequently increasing science motivation as compared to the "small-talk" condition. Prior research (Brown, et al., 2015; Smith, et al., 2015) has shown that increasing participants beliefs about communal goal affordances in science can increase science motivation. The current study did not successfully manipulate communal goal affordances, and, in turn, conclusions about the efficacy of the intervention cannot be drawn. The current study did, however, find evidence that increases in perceived communal goal affordances are related to increases in participant's sense of belonging in science which were related to increases in science motivation.

Within the indirect effects model, the current study tested for two distinct indirect effects between the questions asked and science motivation. Pathway 1 looked at how our experimental condition's questions predicted stereotype threat, how stereotype threat predicted communal goal affordances, how communal goal affordances predicted belonging in science, and lastly how belonging in science predicted science motivation. It was found that our experimental conditions did not predict stereotype threat. Additionally, it was found that stereotype threat did not predict communal goal affordances. This finding represents a novel analysis on the nature of stereotype threats effect on communal goal affordances. It was found, however, that communal goal affordances predicted belonging in science, in so much that the more participants reported communal goal affordances the more they were likely to also report higher belonging in science. Furthermore, belonging in science predicted science motivation, in that the more participants reported belonging in science, the more likely they were to report science motivation. This finding offers additional evidence as to the importance of communal goal affordances in encouraging women's sense of belonging in science, leading to increased science motivation. Pathway 2 looked at how our experimental condition's questions predicted stereotype threat,

how stereotype threat predicted state anxiety, how communal goal affordances predicted belonging in science, and lastly how belonging in science predicted science motivation. It was found that stereotype threat did predict state anxiety, to the extent that those who reported more stereotype threat were more likely to report state anxiety. State anxiety was not, however, predictive of belonging in science. These findings represent a novel analysis on how state anxiety in a science context effects belonging in science and science motivation.

Limitations

The Stereotype Threat Measure. Using standard best-practices for scale reliability (α = ~.80; Santos, 1999), the composite measure for stereotype threat failed to meet this standard (α = .62). One potential reason for this could be broad differences in interpretation; in that participants may have failed to interpret the copy task as a scientific task, thus, not linking their abilities on the task to their abilities in science. For instance, the scale-item: "I am worried that, because I know the negative stereotype about women and science ability, my anxiety about confirming this stereotype negatively influenced how I performed on this science task" may have invoked participants to think about their abilities on this particular task, as opposed to their abilities as they relate to science. This limitation could be overcome by phrasing the measures questions to target performance and perceptions in science in general, as opposed to specifically on the task (e.g. "I am worried that, because I know the negative stereotype about women and science ability, my anxiety about confirming this stereotype negatively influences how I perform on science tasks".)

Wrong Target Population. The current study utilized a convenience sample comprised of a majority of undergraduate psychology students, with a median age of twenty. As such, this sample may have had two inherent flaws: [1] participants may not have had malleable attitudes

towards themselves and their role in science as compared to a younger sample, and [2] participants were largely psychology majors, or other social science majors, who may perceive themselves as already being a part of a STEM field. The first potential flaw, that participants may not have had malleable attitudes, is informed by research suggesting that women's attitudes towards science is highly affected by prior achievement and performance (Shaffer, Marx, & Prislin, 2013). From this understanding, by the time these students enter college their self-perceptions and attitudes towards science are based on years of experiences prior to entering college, and thus remain relatively stable. The second potential flaw, an overabundance of psychology majors in the sample, assumes that participant self-reports were biased towards positive self-perceptions within STEM due to participant's belief that they were already members of a STEM field. For instance, the mean across groups for stereotype threat (M = 1.75; on a 5-point scale) was relatively low, while the mean across groups for science domain identification (M = 3.64; on a 5-point scale) was relatively high. This may elude to participants having reported low rates of stereotype threat and high identification with science due to their membership in a STEM field; establishing a sort of self-selection bias in the sample. Utilizing a younger and more academically diverse sample of girls, who may have more malleable attitudes about their STEM related capabilities and role within science, may result in an effective communal goal affordances intervention as evident by increases to their sense of belonging within science and subsequently increases in their science motivation.

Limited Scope of the Intimate Interaction. The original interpersonal interaction by Aron, Melinat, and Aron (1997) consisted of over sixty questions and took almost ninety minutes to complete in its' entirety. This full interaction was reduced to six questions per condition and only fifteen minutes for this study for the sake of time and financial feasibility. Although this abridged

interaction allowed for the current study to be completed in under one hour, perhaps it inadvertently limited the effectiveness of the manipulation. For instance, regardless of condition, participants could deduce two similarities between themselves and the confederate. First, that they were both women, and secondly, that they were both psychology students (due to the nature of the participant pool being almost all psychology majors). Because of this, some baseline relationship may have been formed regardless of condition. This, coupled with the abridged application of the full interaction may have lessened the extent to which the "fast-friends" condition could foster an intimate relationship relative to the "small-talk" condition. Utilizing the full interaction should theoretically result in a more robust relationship being formed, thus lending itself to a successful communal goal affordance manipulation.

Future Directions

Future directions for this research should include a reviewal of the stereotype threat measure (Deemer, Thoman, Chase, & Smith, 2014) in order to most adequately assess stereotype threat within the context of science. Additionally, a more robust and thorough implementation of the interpersonal interaction (Aron, Melinat, & Aron, 1997) should be used in order to maximize the potential differences between conditions. Lastly, a younger and more academically diverse population should be utilized in order to obtain a more representative sample of women.

Additional Analyses. Beyond the pre-registered planned analysis, the additional exploratory variables of science domain identification, partner ratings and the alternative measure of motivation (i.e. the copy task) will be used to conduct addition analyses. More specifically, using science domain identification as a grouping variable (i.e. those who do not identify with the domain of science versus those who do) in order to conduct separate path analyses using these two groups. Furthermore, using partner ratings as a potential moderator

variable or including it as a covariate in further exploring the effectiveness of the communal goal affordance intervention. Lastly, exploring the role of participants completion rates on the copy task as an alternative measure of science motivation.

Conclusion

The pattern of results illustrated an unsuccessful manipulation of participants attitudes on the studies dependent variables. This may be due to problems with the implementation of the interpersonal interaction as well as our sample representing an indirectly self-selected group of women already within science. The results also did not support the notion of stereotype threat indirectly affecting science motivation via communal goal affordances or state anxiety's effect on belonging in science. The current study did, however, contribute to the body of evidence suggesting the importance of communal goal affordances in science motivation via increasing women's sense of belonging in science. These findings suggest an alternative theoretical model for understanding how stereotype threat contributes to women's science motivation.

Appendices

Figure 1: Science Flier

Discoveries in Science Begin with You!

The most compelling and important scientific discoveries across all fields of science begin with day-to-day tasks in classrooms and laboratories across many universities around the world.

Students and research assistants play a large role in these discoveries, sometimes in ways that don't obviously seem all that "important" or "meaningful".

No scientific discoveries would occur without students' important work on:

- Data Entry
- Data Collection
- Note Taking
- Coding

These science tasks prepare the next generation of scientists for ground breaking discoveries.

Figure 2: The Science Copy Task

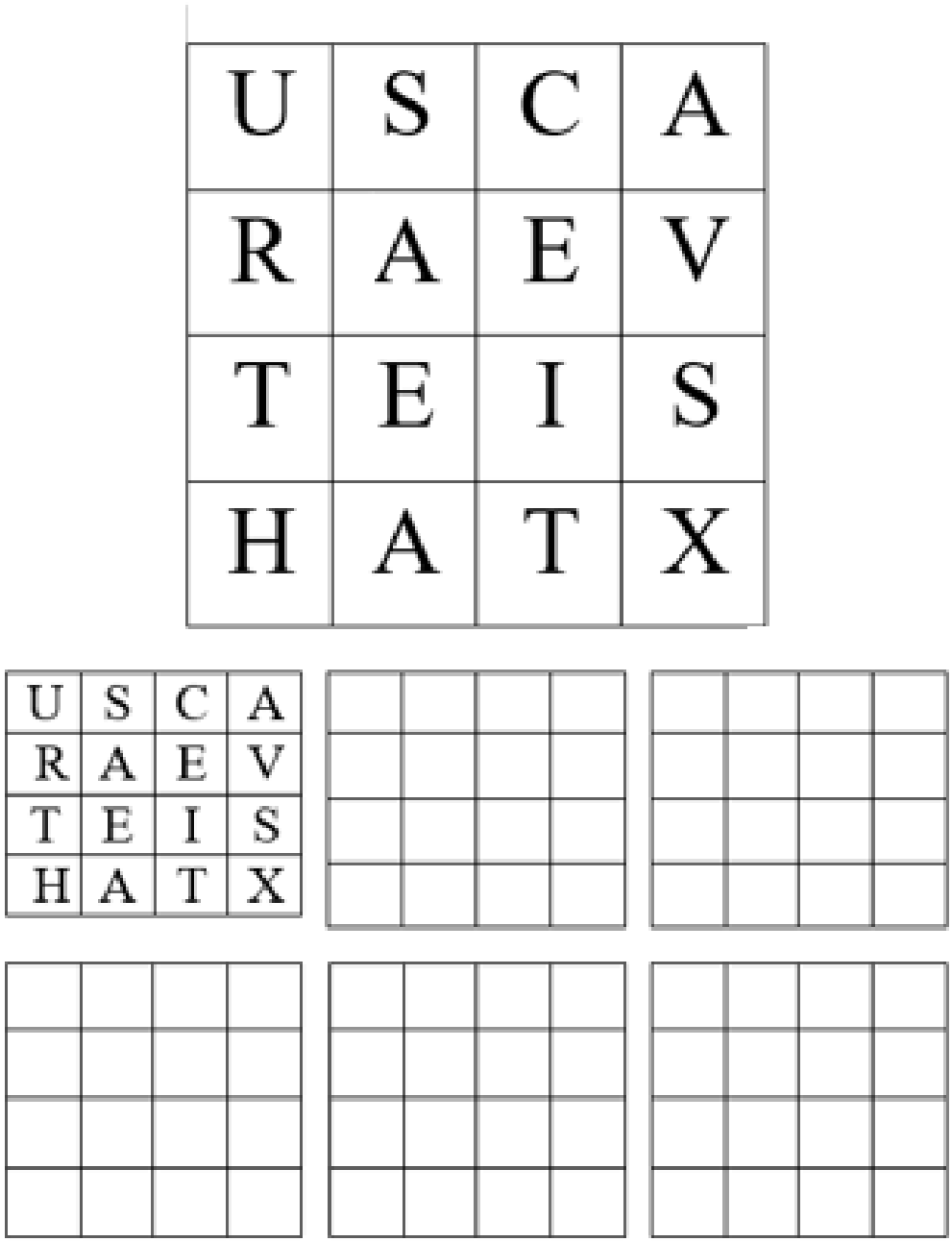

Figure 3: Proposed Path Model

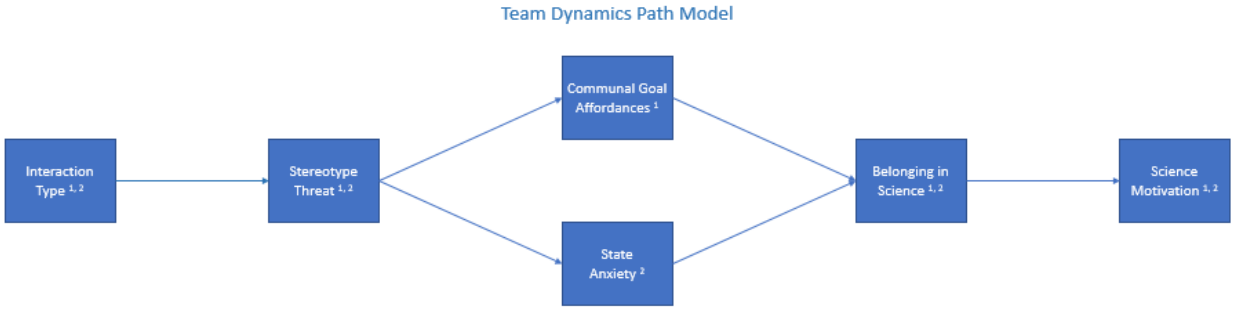

Figure 4: Resulting Path Model

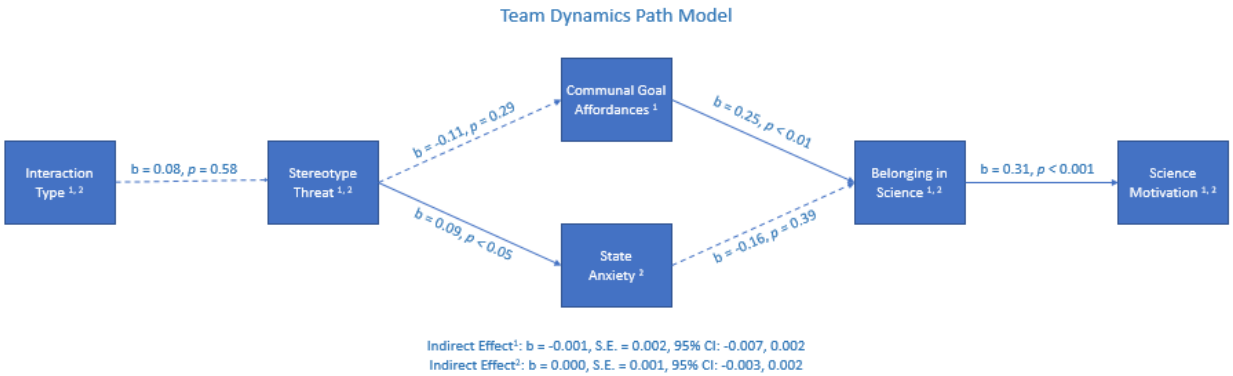

Table 1: Interpersonal Interaction Questions

"Small-Talk" Questions	"Fast-Friends" Questions
1. What is your preferred method for getting the news and why?	1. Given the choice of anyone in the world, whom would you want as a dinner guest and why?
2. Name three things you've done today.	2. Name three things you and your partner appear to have in common.
3. What was your first impression of UNF when you arrived here?	3. What do you value most in a friendship?
4. Are you more of an early riser or night owl? Why?	4. Describe a long-term goal of yours that you have shared with another person.
5. What is the best book you're read recently that your partner has not read? Tell your partner about it.	5. Your house, containing everything you own, catches fire. After saving your loved ones and pets, you have time to make a final dash to save any one item. What would it be?
6. Where are you from? Share 3 interesting things about your hometown.	6. Generate 3 "we" statements. For example, we are both in this room feeling…"

Pre-Registration available for review here: https://AsPredicted.org/afp5k.pdf

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